provided in response to positional information from a force-sensitive pad on surface **1810**.

FIG. **19** illustrates a controller adapted for use in controlling an object or cursor in **2** dimensions. A force-sensitive matrix sensor **1905** provides two signals, one X, and one Y, in response to the position of a force applied to the sensor. Further, sensor **1905** includes a raised area **1910** on its four edges which is tactilely distinguished from flat surface **1915** of sensor **1905** by the inclination of area **1910** relative to surface **1915**. In the preferred embodiment, area **1910** includes an area at each of the four edges of surface **1915**. The edges are inclined and raised relative to flat surface **1915**. This provides an area of the sensor tactilely distinguished from flat surface **1915** which operates in a different mode. For example, in a relative mode for X and Y-position a change in position on sensor area **1915** is interpreted as a proportional change in cursor position. Once the operator's finger reaches raised area **1910** a steady force (without movement) on raised area **1910** is interpreted as a continuation of the cursor movement. Cursor movement can be continued at either the most recent velocity along an axis, or at a preset speed, as long as a force is detected on the portion of area **1910** on that axis, such as portion **1920** with regards to movement in the positive X-direction. Alternatively, the speed of the cursor movement along an axis could be proportional to the amount of force applied to area **1910** on that axis. Thus, area **1920** would provide control of +X cursor speed, area **1925** would provide control of +Y cursor speed, area **1930** would provide control of −X cursor speed, and −Y would provide control of −Y cursor speed. In any case, the operator is provided with the advantages of two alternative operating modes and the ability to combine the two modes in order to continue cursor movements in a desired direction even after reaching the edge of sensor area **1915**.

The controllers described in FIGS. **1–10**, **13** and **14** are adapted for use in the Cartesian coordinate system. In general, they can be categorized by the modes used for position and rotation control. Specifically, a "push mode" for position control is used in the embodiments described with reference to FIGS. **1**, **8**, and **9*a***. In contrast, a "drag mode" for position is used in the embodiments described with reference to FIGS. **3**, **6**, **7**, and **10*a–c***. With regards to rotation, three general modes are used. "Gesture" mode for rotation is used in the embodiments described with reference to FIGS. **3** and **6**. "Push mode" or "torque mode" for rotation is used in the embodiments described with reference to FIGS. **9*a–d***. Finally a "twist mode" for rotation is used in the embodiments described with reference to FIGS. **7** and **8**. These modes can be combined in a number of ways as taught by the various embodiments. Further, different modes can be adapted to the cylindrical and spherical controllers taught with reference to FIGS. **11**, **12**, **16** and **17**.

Accordingly, while the invention has been particularly taught and described with reference to the preferred embodiments, those versed in the art will appreciate that minor modifications in form and details may be made without departing from the spirit and scope of the invention. For example, the embodiments variously describe the derivation of information from single or multi-bit sensor and A/D converter combinations. It should be well understood that these could be used interchangeably as would best fit the application. Further, while the sensors on the Cartesian controllers are generally aligned on and orthogonal relative to axes, as illustrated in FIGS. **1** and **3**, these sensors can also be inclined as illustrated in FIG. **13**, and still are considered to be generally aligned and orthogonal to the axes. Accordingly, all such modifications are embodied within the scope of this patent as properly come within my contribution to the art and are particularly pointed out by the following claims.

I claim:

1. A touch-sensitive manually operable controller for providing positive and negative control signals relative to three axes, the controller having six sensors mounted on its outer surface, two sensors mounted on opposing sides of the controller relative to each axis of a Cartesian coordinate system, the six sensors including:

a first sensor mounted along the negative X-axis for providing a positive X-axis control signal in response to pressure;

a second sensor mounted along the positive X-axis for providing a negative X-axis control signal in response to pressure;

a third sensor mounted along the negative Y-axis for providing a positive Y-axis control signal in response to pressure;

a fourth sensor mounted along the positive Y-axis for providing a negative Y-axis control signal in response to pressure;

a fifth sensor mounted along the negative Z-axis for providing a positive Z-axis control signal in response to pressure; and

a sixth sensor mounted along the positive Z-axis for providing a negative Z-axis control signal in response to pressure, wherein the controller further includes means for providing combined X-axis control information in response to the integral of the difference between the positive and negative X-axis control signals, providing combined Y-axis control information in response to the integral of the difference between the positive and negative Y-axis control signals, and providing combined Z-axis control information in response to the integral of the difference between the positive and negative Z-axis control signals.

2. A touch-sensitive manually operable controller as in claim **1** wherein the signals from the six sensors have more than two different output levels.

3. A touch-sensitive manually operable controller for providing position control information relative to three axes, the controller comprising three force-sensitive matrix sensors mounted on its outer surface, a first sensor generally aligned on and orthogonal relative to the X-axis of a Cartesian coordinate system, a second sensor generally aligned on and orthogonal relative to the Y-axis of a Cartesian coordinate system, and a third sensor generally aligned on and orthogonal relative to the Z-axis of a Cartesian coordinate system,

the first sensor for providing a first Y-signal in response to the position of a force applied to the sensor along the Y-axis and a first Z-signal in response to the position of a force applied to the sensor along the Z-axis,

the second sensor for providing a first X-signal in response to the position of a force applied to the sensor along the X-axis and a second Z-signal in response to the position of a force applied to the sensor along the Z-axis,

the third sensor for providing a second X-signal in response to the position of a force applied to the